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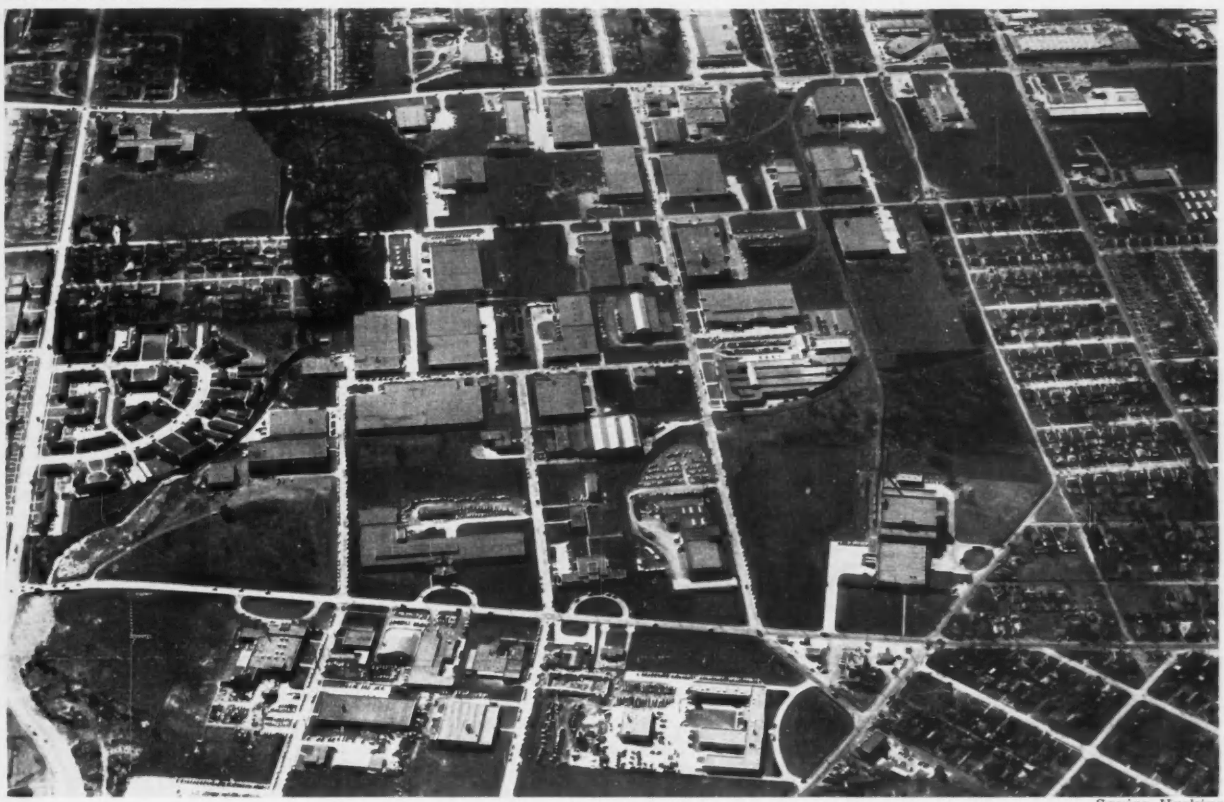
PERFORMANCE STANDARDS FOR INDUSTRIAL ZONING AN APPRAISAL

By Robert B. Garrabrant

Secretary, Industrial Council, Urban Land Institute



THE JOURNEY TO WORK NEED NOT BE LONG AND ARDUOUS. —*Squire Haskins*

Carefully selected plants in the Airlawn Industrial District, Dallas, Texas, operate as good neighbors to a built-up residential neighborhood. Can zoning regulations be framed to permit and encourage comparable developments?

Editor's Note

In the constantly changing technical world in which we are living, it is continually necessary to seek adjustments in our legal controls to meet new developments. Nowhere is this more evident than in the industrial field.

The article on page 3 deals with a complicated subject in simple terms and discusses one approach to the problem of adjusting zoning codes to modern industrial processes.

It seems clear that in theory, at least, industrial performance standards have much to offer in improving our zoning regulations. The real test of performance zoning will come, however, in how it is administered and enforced at the City Hall level, not only at the initial stage of development but in terms of continued compliance. It also suggests that a much higher degree of technical competence will be required in our zoning offices than is prevalent today.

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Plan-itorial . . .

The New Highway Program and the Cities

Enactment of the greatly expanded Federal highway program will result in substantial changes in many American communities. It is doubtful if many cities are aware of, let alone prepared for, the impact of this legislation upon their internal affairs.

This comprehensive new highway program will stimulate both rural and urban construction. Strong emphasis is placed, however, upon new construction where the traffic load is heaviest, and this is usually in and near centers of population. About $20 billion is expected to go into urban highways.

The program also calls for facilities designed to meet the traffic demands of the future, which will mean many more high-capacity, multi-lane, grade-separated, limited-access expressways. Only the relatively few major cities that have had actual experience with the layout, design, construction, and impact of such superhighways can fully appreciate the many complexities involved. The following questions are designed to bring out some of these. The answers can only be worked out locally.

Physical Changes

Construction of a high-volume trafficway calls for a wide right-of-way that can, and frequently does, cut a swath a full city block in width and involve the demolition of many existing buildings. What types of buildings will they be? Where will the displaced homes, shops, perhaps industrial plants, be re-located? What will this large-scale relocation do to the city's master plan? How will it affect zoning? What pending urban renewal and redevelopment projects are contemplating urban expressway locations?

The new highway will facilitate access to the central business district. Will there be enough capacity downtown to accommodate this additional traffic? Will there be adequate parking facilities? What will be the effect upon mass transportation?

The new highway will also facilitate egress to at least parts of the fringe area. To what extent will it accelerate the decentralization of residential, commercial, and industrial buildings? Are there adequate controls in the environs?

The new highway will stimulate traffic movement in and out, but will also serve to some extent as a barrier to transverse traffic. To be sure there will be crossings, but they will be minimized because they are expensive. This may mean extensive readjustment of the service areas of schools, parks, police and fire stations, and other municipal facilities. It may require new construction in these fields.

The new highway will, of course, involve extensive readjustment of water lines, sewers, and other utilities.

Financial Effects

Urban superhighways are very expensive. The Federal government will pay part of the bill, but not all of it. State and local contributions will be called for. Is the city prepared to pay its share? Is it ready, in addition, to meet the cost of the many local readjustments indicated above? Does it have a city plan and public works program sufficiently flexible to meet the requirements as they develop? Finally, what will be the net effect of the new highway upon land values and the municipal tax base?

Many more such questions could be posed, but enough have been presented to indicate that new major highways, although badly needed, will not come as an unmixed blessing to American cities. It is not too early to start preparing for the impact—in fact, it is later than we think.

Location decisions will materially affect the costs of new urban highways—not only the direct costs of land acquisition and construction but also those indirectly resulting from the readjustments indicated. City governments, particularly their local planning commissions and public works departments, should be prepared to contribute materially in selecting the best possible location for a new urban expressway. Some state highway departments have worked closely with city officials and planning commissions in outlining local highway networks—

(*Continued on Page 6*)

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INDUSTRIAL ZONING VALID

Exclusive industrial zoning by barring residences from an industrial zone has been held valid by a recent California Court of Appeals decision of major importance. Before this decision, prevention of residential development in an industrial zone had long been advocated but never tested. In turning down an application for creating a 254-house subdivision in a Contra Costa County area zoned for industry, the California Court held that local zoning authorities had exercised proper discretion in restricting the area to industrial use.

PLAN ANALYSIS SESSIONS

Meetings for analysis of projects submitted by sustaining members of U.L.I. are scheduled as follows:

Community Builders Council—September 20-22, at New Orleans.

Industrial Council—November 9, at St. Louis.

Requests for time allotments at these meetings can be sent in advance of the regular announcement.

PERFORMANCE STANDARDS FOR INDUSTRIAL ZONING AN APPRAISAL

By Robert B. Garrabrant

Secretary, Industrial Council, Urban Land Institute

Zoning is designed to promote orderly urban development by allocating designated areas to the various types of land uses needed in a complex society. In an industrial nation, land zoned for industry is a requirement in most communities.

A zoning ordinance usually sets up more than one kind of industrial zone, the purpose being to differentiate between so-called "light" and "heavy" industries. Everyone understands the distinction between these two terms, yet they defy precise definition. The real purpose, of course, is to give preferential treatment to "clean" industrial operations without stigmatizing the others as "dirty," an antonym which may at times be accurate but which makes no friends.

In most existing zoning ordinances, the problem of defining "light" and "heavy" industry has been avoided by laboriously listing, by name, the numerous classes of industrial activity that will be permitted, or alternatively prohibited, in a specified zone. This method has proved unsatisfactory for a number of reasons, including:

1. There is no general agreement on the precise dividing line between light and heavy industry.
2. Technological progress is changing the characteristics of many named industries, thus rendering the lists obsolete.
3. It is difficult to make the lists all-inclusive.

From the zoning standpoint, the significant factor in the classification of an industry is its effects upon nearby land uses. Some plants are unobtrusive and unobjectionable neighbors; some necessarily produce external effects that are incompatible with nearby residential amenities, or even with commercial or some other industrial uses.

It has been proposed, therefore, that industrial activities be classified and assigned to zones solely on the basis of their external effects. For each industrial zone, standards would be set up prescribing permissable limitations on noise, smoke, odor, vibration, glare, and other external emissions. Any industrial facility, regardless of process or product, would be permitted to locate in the zone if it would abide by these limitations. This is performance zoning.

In theory, performance zoning for industry makes sense. Whether the theory can be translated into practice raises a number of questions not yet clearly answered. Can the various emissions be measured? Can standards be written into ordinances that will effectively keep the nuisance factors within bounds? What new problems of administration will face municipal authorities operating under a performance-type zoning code? Can **continued** performance be effectively policed, or will the result be gradual and insidious decline? In short, is performance zoning workable?

This approach to zoning for industry is relatively new, and actual experience with it is limited. About a dozen ordinances containing performance standards have been written (see Table 1) the earliest of which was adopted as recently as 1952 by Warren Township, Michigan. The country's second largest city, Chicago, is now considering such an ordinance, prepared after very thorough study. Much intelligent effort has gone into the preparation of performance zoning codes, but we are still in the cut-and-try stage of this promising evolution in zoning practice.

Table 1

Localities Where Performance-Type Zoning Ordinances Have Been Proposed or Adopted

Albuquerque, New Mexico
Anne Arundel County, Maryland
Bismark, North Dakota
Center Line, Michigan
Chicago, Illinois
Clarkstown, New York
Corona, California
Denver, Colorado
Parsippany-Troy Hills, New Jersey
Penn Township, Pennsylvania
Rye, New York
Southfield Township, Michigan
Warren Township, Michigan

The purpose of this article is to examine the various performance zoning ordinances that have been prepared, to explore the standards suggested to control various industrial emissions, and to evaluate insofar as is now possible the potential usefulness of performance standards for each of these emissions. No attempt will be made to recommend numerical standards for adoption nor to choose between differing solutions to the same problem. Such judgments must await further experience with this new development.

Noise

Sound is a rapid pulsation in air pressure. Its **intensity** can be measured with a sound meter and expressed in decibels, a unit of pressure. A simple decibel limitation, however, cannot be an adequate safeguard in zoning because the annoyance caused by sound waves also is influenced by their **frequency,** measured in vibrations per second or wave lengths. Noises that "set the teeth on edge" are usually in the shrill high-frequency range. They cause discomfort out of proportion to their decibel ratings.

Another unit, the sone, has been proposed as a measure of noise effect upon the human ear. To determine the sone value of a complex sound, a band filter is used to separate the full noise spectrum into a numbers frequency sectors, the decibel intensity in each of these is measured with a sound meter, and a weighted value is calculated. The utility of the sone has been questioned for two principal reasons: (1) acoustical experts are not in agreement as to its validity as a measurement of sound perception; (2) no single instrument can measure the sone value directly. Nevertheless, the sone is a definite standard and can be used where it is deemed suitable.

Of the ordinances studied, that prepared for Chicago has the most comprehensive standard. It consists of a table of ten frequency ranges covering the entire audible spectrum. For each of these octaves, a permissable maximum sound pressure level, in decibels, is given. Specific values vary from 32 decibels at the high end of the frequency scale to 72 decibels for the lowest pitches. Measurements are taken at the zone boundary, and levels 7 decibels higher are allowed where the adjoining district is zoned for business uses instead of residence. These limits are applied without variation to all industrial zones.

The Clarkstown ordinance uses a similar table, but the permitted maximum

varies from 36 to 74 decibels over the frequency range. For noises not radiated between 10 p.m. and 7 a.m., allowable maximums are adjusted up or down in accordance with noises characteristics and duration.

Three ordinances specify sone values as maximums. The lowest is 20 sones for a Restricted Industrial zone in Penn Township, as compared with 50 sones for an Unlimited Commercial zone in Albuquerque, a city which imposes no noise limits in its M1 and M2 Industrial zones.

Other ordinances impose a simple decibel limitation. This, for reasons already stated, may not prove satisfactory in controlling high-frequency noises. To meet this point lower maximums are sometimes imposed upon noises that are objectionable on account of "intermittance, beat frequency, or shrillness." Limits usually fall within the 50-75 decibel bracket.

There is no uniformity in specifying where measurements shall be taken. In some cases it is at the zone boundary, in others at the property line, and sometimes the point is left unspecified.

Summing up, it appears that while it is possible to write a performance standard to keep industrial noise within desired limits, an effective standard cannot be simple and may possibly involve some difficulties in administration. More experience in the operation of regulations of this kind will probably develop greater confidence in this field.

Smoke, Dust, and Particulate Matter

Widespread experience with smoke control ordinances has made this area the one to which performance zoning standards can be most easily and effectively applied. The Ringelmann chart of the U.S. Bureau of Mines can be utilized to classify visible emissions (smoke). Techniques have been worked out for the measurement of deposits of fly ash and other particulate emissions and for the measurement of particle sizes. Controls can be varied from absolute prohibition (in effect, barring plants with smokestacks) to specified allowances in areas where some leeway is permissible. Ringelmann #1 or #2 are the limits most commonly used.

This type of nuisance, when uncontrolled, gives rise to frequent complaints. Housewives react to discolored paint, the necessity for frequent dusting, and soiled laundry. Judiciously selected controls can clear the way for "clean" industries to locate near residential areas, while relegating those which must necessarily discharge some smoke and fly-ash to appropriate zones.

One note of caution should be sounded. Zoning is based upon the police power of municipal governments, and the police power must be applied without discrimination. Should a restrictive smoke requirement be adopted for an industrial zone, such an ordinance might be attacked as being discriminatory if it applied to industry restrictions more rigid than, say, to household furnaces. The obvious answer is a city-wide smoke control ordinance. With a city-wide ordinance, zoning restrictions become unnecessary.

As for wind-borne dust, sprays, and mists originating in industrial operations or otherwise, these should not be tolerated in any "clean" industrial zone. Control measures are available, and the prohibition of such emissions is clearly called for.

Odors

The problem here is more psychological than physiological. Even odors that are pleasant in normal circumstances can become annoying in continuing heavy concentrations—for example, coffee or candy. The usual provision is a prohibition of odorous emissions in such quantities as to be "offensive." This is begging the question—who shall determine whether or not the point of offense has been exceeded?

Of course an unpleasant odor, such as hydrogen sulfide, is obnoxious **per se,** but even in this area prohibition is illogical because, no matter how unpleasant, the odor is not perceptible in very weak concentrations. Only when the "threshold of smell" is reached does it becomes a nuisance. And the threshold of smell varies with different individuals.

The "Air Pollution Abatement Manual," published by the Manufacturing Chemists Association, Washington, D. C., contains a table giving the concentration, in parts per million, of many chemical substances at what is considered to be the odor threshold. While this is probably the best available guide, it is neither complete nor definitive; it omits some odoriferous substances and gives conflicting values for others. For pyridine, for example, six values are given ranging from 0.00032 to 10.0 parts per million.

Odor control is an area in which the ability to write definite standards presently seems to be questionable. Probably the best compromise, for restricted industrial zones, is clear-cut prohibition without regard for the fine points of odor perception, at least until a workable standard can be evolved.

Toxic or Corrosive Gases

Many of the considerations that apply to "Odors" are also pertinent to this section, the difference being that the risk is not simply one of unpleasant nuisance, but of health hazards and property damage.

Again, a source of information on permissable limits is available in the "Air Pollution Abatement Manual." In addition to the odor threshold, values are given at which gas-air mixtures become painful to the eyes, injurious to vegetation, and dangerous to health. However, these values were calculated on the basis of exposure during normal working hours only—no figures are available for continuous exposure.

Again the conclusion must be reached that we are not yet ready to write permissive standards of exposure for gases of this dangerous nature. This is particularly true in view of the fact that while the **presence** of these gases can be detected by known methods, determination of the **degree of concentration** is very difficult. So complete prohibition is the best available answer.

A contradiction can be cited. Carbon monoxide is a very dangerous gas when concentrated. Yet it is emitted in considerable quantities in concentrations above the limit of danger by motor vehicles. Can a zoning ordinance restrict an industrial generator of this gas while the city permits uncontrolled emissions from traffic?

Vibration

Earth tremors caused by certain types of machines are annoying and, in extreme cases, can cause wall cracks and other property damage. While the science of seismology provides units of measurement and some guidance on standards (Seismic Effects of Quarry Blasting, Bulletin No. 442, U.S. Bureau of Mines), in zoning ordinances the usual control is a prohibition of "perceptible" vibration at the zone boundary. In some cases a minimum distance from the machine to the zone or property line is specified, but in this connection it should be noted that different types of soil transmit vibrations varying distances, and a requirement proving satisfactory insulation in one area may be unsatisfactory in another.

Glare and Heat

Unscreened welding and heating operations can cause complaints. The remedy is this case is simple. Glare

and heat sources in industry can and should be screened so as to be confined to a room, the bulding, or in any event the plant site. While these effects can readily be measured in terms of foot-candles, B.t.u.'s etc., there is no particular point in imposing numerical limitations. Prohibition of unscreened emissions is feasible and desirable except for blast furnaces and similar large installations. It should be imposed in all restricted zones and should cover exterior plant lighting.

Fire and Explosion Hazards

Materials used by industry can be graded from incombustible through various grades of flammability to those which decompose by detonation. Explosives, of course, should not be permitted in any urbanized area except under rigid safety standards. Hazards incident to the storage and use of materials classed as slow-burning, moderate-burning, free-burning, and intense-burning can be controlled and regulated for various zones by requiring set-backs, enclosure within incombustible walls, automatic sprinkler systems, and by prohibition. A great deal of work has been done in this fire-prevention area and no serious difficulty should be met in adapting performance zoning standards graded according to neighborhood requirements. In their preparation care should be taken to mesh the zoning requirements with building codes and other existing safety regulations.

Industrial Wastes

Direct discharge of untreated industrial wastes into a stream can create a nuisance. It is questionable, however, whether controls over such conditions belong in the zoning ordinance. In most cases state or local health and sanitary regulations apply and should be adequate.

Nevertheless, some performance zoning ordinances do include provisions of this type. Perhaps this indicates the absence or inadequacy of other controls. Numerical standards are derived from the fields of sanitary engineering and stream pollution control. Although complex, they present no problems, as ample guidance is available.

Electromagnetic Interference

A recent trend is the large increase in the number of research and development laboratories operated by industrial firms but not engaged in what is normally thought of as industrial production. Some jurisdictions have created zones to accommodate this type of installation. A performance standard governing electromagnetic interference has been adopted in one instance as a special-purpose regulation designed primarily to protect laboratories engaged in electronic research from conditions prejudicing their operations. It is not necessary in a normal industrial zone. The standards used are highly technical.

Radioactive Emissions

This being the atomic age, with the use of radioactive materials by industry continually increasing, at least two zoning ordinances have been written to include safeguards against radioactive emissions. The standards used are based upon published permissable radiation figures of the National Bureau of Standards.

As national safety standards control the use of radioactive materials the need for including them in a local zoning ordinance may be questioned.

Density and Yard Controls

Early zoning ordinances imposed few or no restrictions over the manner in which land zoned for industrial use could be developed. Over-intensive use is detrimental to both the community and the businesses concerned. Modern zoning practice recognized the need for and desirability of restrictions covering such factors as minimum lot area, set-backs, maximum height of building, lot coverage, and floor-area ratio, as well as provisions for off-street parking and loading, and the prohibition of residential development in industrial zones. Most of the performance zoning codes thus far written include restrictions of this type. These are desirable, even necessary to insure proper development. However, they are specification standards, not performance standards, and are, therefore, outside of the scope of this discussion.

Listing by Industry

As already stated, one of the major objectives of performance zoning is the elimination of arbitrary lists consigning named industries to one zoning classification or another. If it were now possible to write definitive standards for all of the categories discussed above in a form that could readily be enforced, such lists could be eliminated. But this is not feasible in the present state of knowledge. Therefore, use lists are found in several of the performance zoning ordinances that have been examined. These are applied in several ways:

1. To prohibit named industries without regard to performance standards otherwise applied.

2. To list selected industries permitted to locate in a high-standard industrial zone **provided** that they comply with performance standards.

3. To specify industries which "customarily" result in undesired conditions and to subject them to special procedures before issuing a permit.

Of these, the first two use performance zoning as a supplement to, rather than a substitute for, the older type of regulation. Only the third provides the greater flexibility in the location of well-behaved industrial plants which is the prime purpose of performance zoning.

Conclusions

The concept of performance zoning for industry is relatively new, and experience with it is limited. On the basis of the considerable amount of effort expended in preparing performance zoning ordinances and of some experience with their administration, it may be concluded that it is feasible to prepare workable restrictions prescribing, for each type of industrial zone, standards limiting smoke, dust and dirt, glare and heat, vibration, fire and explosive hazards and, where needed, industrial sewage. As respects noise, odor, and toxic or corrosive gases, the outlook for performance standards is favorable but some difficulties remain to be resolved before such standards can be fully definitive and simple to administer.

Nothing has developed to impair the prospective advantages of performance industrial zoning. Further development and use of this idea will be beneficial both to industries seeking suitable locations and environments and to communities seeking additional industrial employment opportunities and tax values. These advantages are well worth seeking and justify further attempts to improve and perfect this new type of zoning.

Experience being the best teacher, it is recommended that communities, in preparing new and revised zoning ordinances, should consider the progressive adoption of some performance standards for industry. Such pioneering risks as may be involved can be minimized by requiring thorough review of border-line cases and by calling in, when necessary, expert consultants. This course my increase the burden of

administration, but the results should be well worth the additional effort involved.

One final caution is in order. In performance zoning even more than in traditional zoning, blind copying of provisions from other jurisdictions or of standards prepared for non-zoning application can lead to serious trouble. What others have done may furnish useful guidance, but should not be accepted without careful consideration of the conditions, circumstances, and desires of the home community. A performance-standard zoning code must be custom-tailored to the community; it should not be bought ready-made.

THE NEW HIGHWAY PROGRAM AND THE CITIES

(*Continued from Page 2*)

New York State being an outstanding example. Others have yet to develop this teamwork or to understand the nature of the urban road. Traffic desire lines and topography are powerful determinants in such decisions if properly interpreted, but they are by no means the whole story. Settling the optimum location from all aspects will not be a simple task, even with the most cordial and active collaboration between state and municipal agencies. The new Federal program, with its emphasis on urban construction, can serve as a powerful catalyst in bringing the state and local levels of government closer together. But the ingredients needed in the process will have to be carefully weighed and integrated.

R. B. G.

HOUSTON'S NEW PARKING GARAGE

A 1,500-car public parking garage owned and operated by private enterprise was opened recently in Houston, Texas. The $3,000,000 facility, called the Ten Ten Parking Garage, is situated in the heart of Houston's central business district. Its location, size and design offer motorists unexcelled parking service from the standpoint of convenience and abundance of space. As the South's largest privately owned parking garage, it offers the equivalent of seven city blocks of off-street parking. For it has seven parking levels—two of them underground—in a building which covers an entire city block.

Its 1,500 car capacity is equal to 10 miles of curbside parking, assuming the absence of parking restrictions along both sides of a five-mile street. Offering accommodations to both short-time customers and monthly, contract parkers, it is designed to handle an average-day load of approximately 3,000 cars. This much of an increase in the city's off-street parking facilities constitutes a giant stride toward alleviating downtown Houston's traffic congestion. Thus another road block has been thrown up against the trend toward the decentralization of business. Patronage of downtown commercial and financial establishments is encouraged, thereby, sustaining and increasing downtown property and tax values.

The garage was built and is operated by the Ten Ten Travis Corporation. Carl Myers, president of the corporation, in discussing the thinking behind its construction, said, "Having made a large investment in downtown Houston, it was obviously good business to do our part to keep the area prosperous."

Concept of the Garage

Intensive studies of traffic and parking patterns led the way in the planning of the garage. A traffic design was drawn up before engineering aspects were considered. Experts in the fields of traffic movement and parking were retained by the owner.

Thomas E. Willier, Houston traffic and business consultant, evaluated garage parking and future business potentials of downtown Houston, and prepared the traffic design and operational plan of the garage. He also made use of the "Houston Origin and Destination Survey," compiled in 1953 by the Texas Highway Department and the City of Houston. Advice was obtained also from the Bureau of Roads of the U. S. Department of Commerce and the Department of Traffic and Transportation, City of Houston.

Ease of accessibility was a paramount consideration. It was found that the site of the garage offers a major advantage in that the traffic direction of the four one-way streets which bound it—Travis, Milam, Lamar and McKinney—makes it impossible to turn left at any corner of the block. Therefore, there can be no block-circling traffic to interfere with movement through the garage's entrances and exits.

It was also determined that adjoining street traffic capacities are such that ingress and egress are possible with a minimum of interference even during peak traffic hours.

Another major advantage of the site is that it is easily accessible from the downtown district's major office buildings and business houses. Two skyscraper office buildings—the Bank of the Southwest and the Commerce Building—are connected to the garage by underground pedestrian walkways.

The area's traffic flow and patterns played a prime role in determining the internal design of the garage, as well as its type of operation. A policy of accommodating both contract parkers and short-time or drop-in trade resulted. Parking spaces are divided approximately fifty-fifty between these two groups. This policy discourages congestion, both within and in the immediate vicinity of the garage, since short-time parkers normally enter the central business district after and leave it before contract, or all-day parkers, do.

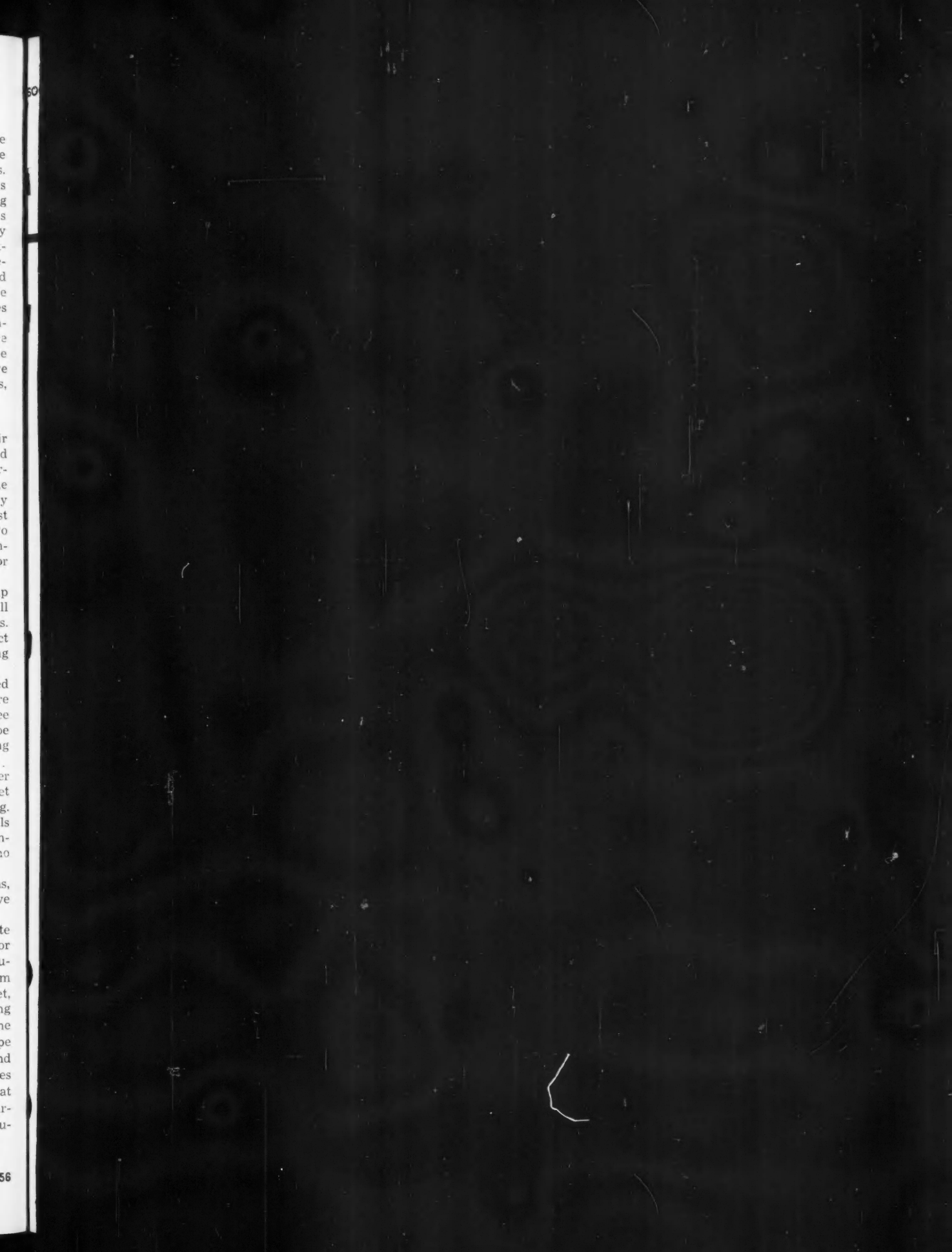
Structural Highlights

The pedestrian tunnel system—air conditioned, acoustically-treated and served by escalators—connects the garage with the new 24-story Bank of the Southwest Building and the 22-story Commerce Building. Thus a motorist may park and visit either of the two office buildings without having to contend with delays from bad weather or street-level traffic.

Two spiral ramps, one each for up and down car movements, connect all seven of the garage's parking levels. Also, two straight-line ramps connect the basement level with two adjoining streets.

The parking areas, with well-defined stalls each 8 feet, 6 inches wide, are laid out so as to provide ample free aisle space, meaning that cars can be driven into the aisles without being blocked by other vehicles.

Comfortable, air conditioned customer waiting rooms are situated on the street level at two corners of the building. Automatic elevators serve all levels from the waiting rooms for the convenience of the contract parkers, who park and pick up their own cars.

As another convenience to its patrons, the garage offers complete automotive servicing and repair facilities.

The building is of reinforced concrete construction, with outstanding exterior architectural treatment. Gleaming aluminum panels two feet wide rise from a sidewalk canopy to the roof parapet, alternating with and partly overlapping darker vertical panels of the same width and material. This louver-type arrangement allows subdued light and free circulation of air but excludes rain, heat and direct sunlight, while at the same time carrying out the appearance of a solid wall of contrasting aluminum panels.